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Information on Methicillin Resistant Staphylococcus aureus (MRSA)

A brief history of the origins of MRSA
Staphylococcus aureus was sensitive to penicillin when it was introduced in the late 1940s but resistance developed almost immediately. S.aureus acquired a β lactamase capable of inactivating the β lactam ring, which is at the core of the penicillin molecule. Lactamase resistant antibiotics (methicillin, nafcillin, oxacillin) remained effective until the early 1960s when S.aureus acquired a new gene that modified its penicillin binding protein. These strains were name methicillin resistant Staphylococcus aureus or MRSA.

MRSA started in hospitals and other medical care institutions
MRSA quickly became known for its ability to cause large hospital outbreaks. Most strains of MRSA are sporadic but a few strains have the ability to spread very rapidly throughout an institution and reach epidemic levels. MRSA became progressively more common and is now endemic. In 1999 the proportion of MRSA among S.aureus hospital acquired infections in the USA was estimated at 50% with large local variations.

MRSA has spread in the community and now is considered to be also a community-acquired organism
The actual prevalence of community acquired MRSA cannot be accurately determined BUT it is estimated that 40% of adult cases may be acquired outside the hospital (Chambers HF, Emerg Inf Dis 2001, 7:178-182).

Community acquired MRSA infections are commonly reported in miscellaneous groups: patients with cystic fibrosis, day-care centers, wrestling teams, and prisons.

The prevalence of CA-MRSA infection was estimated at 208/100,000 in Chicago (Hussain FM, Pediatr Inf Dis J 2000, 19:1163-1166). The prevalence seems to have increased from 10/100,000 in 1988/90 to 259/100,000 in 1993/95.

Hospital acquired MRSA (HA-MRSA) show multi-resistance to other antibiotics while community acquired MRSA (CA_MRSA) remains multi-sensitive.

Resistant to	*S.aureus*	HA-MRSA
Cephalothin	1-5 %	Not rec
Erythromycin	2-8 %	50-60%
Clindamycin	2-5 %	30-40 %
Tetracydine	10-20 %	70-80 %
Tmp-sxt	35%	70-80%
Ciprofloxacin	1-5 %	27.4 %
Vancomycin	0 %	0 %

HA-MRSA strains show much more resistance to all other antibiotics

Tmp-sxt = Trimethoprim-sulfamethoxazole

MRSA are usually NOT more virulent than other S.aureus.
Many strains tend to be simple colonizers, they are present on the skin or mucosa and cause no infection, no disease. Others have the same pathogenic potential than regular S.aureus. No difference was found in animal lethality, in production of extracellular enzymes or toxins, in intraleukocyte survival.

However **CA-MRSA strains may be more virulent**: In 1999 CDC reported 4 cases of lethal MRSA infections among children (12months to 13 years from Minnesota and N.Dakota) who clearly had community acquired infections (hepatic abscess, brain abscess and necrotizing pneumonia). Unlike HA-MRSA strains, CA-MRSA stains produce superantigens (SEB and SEC, but not TSST-1). Superantigen production is a recently described virulence factor of both staphylococci and streptococci and is important because superantigen production by these microbes in immunologically naïve persons can cause toxic shock syndrome.

Colonized individuals are the main reservoir of MRSA
People are normally colonized by S.aureus. Some patients are more often colonized than others: newborns, diabetics, patients with skin diseases (eczema), hemodialysis patients. A small fraction of these S.aureus are MRSA. The proportion of MRSA depends on the locale.

The **sites of colonization** are:
- **NASAL area**
- perineum, anal area
- axillary areas, finger tips
- tracheostomy sites, wounds, sputum from intubated patient

Detection of carriers (in outbreaks or endemic situations)
- Rotate unmoistened nylon swabs 5 times around anterior portion of nares with gentle pressure on nares
- Roll swab onto plates of selective media (Mannitol salt agar) with fixed concentration of antibiotics
- Incubate at 30-35 °C for ≥48 hours
- MRSA carriers: 30,000 CFU per swab

MRSA main mode of transmission is by contact
Staphylococci are transmitted by direct skin-to-skin contact. The source of infection may be a person with infection or a person that is colonized. Usually the organism spreads from hands of the infected/colonized person to the skin of another person. In general, transmission of staphylococci does not occur by the airborne route or through contaminated objects (fomites). **Therefore the single best way to prevent transmission of staphylococci is routine handwashing**.

Droplet transmission can occur only in very special circumstances such as from patients with tracheostomies.

MRSA is rarely transmitted by the environment, BUT in some institutionalized populations it is of major concern: burns units, hydrotherapy.

Colonization is not a sufficient reason to treat
MRSA colonization does not warrant treatment or hospital admission. The decision to treat a MRSA infection should be made based on the clinical judgment of the attending physician.

Hospital, nursing home, extended-care facility admission of a colonized or infected MRSA patient is acceptable medical practice.

There are very few indications for treatment of colonized patients or carriers
Elimination of **MRSA carriage** is NOT systematically recommended for the following reasons:
1-Difficulty in obtaining and in confirming elimination of colonization
2-Promotion of resistance to other antibiotics,
3-Complications due to side effects,
4-Relapses are frequent and multiple treatments would be necessary
5-High cost of monitoring results

How to attempt eradication of carriage?
In some cases, physicians decide to treat carriers. The following regimen has been used for eradication of nasal carriage:

- Most antibiotics do not reach sufficient concentrations in nasal secretions
- Susceptibility testing necessary prior to eradication

Topical		
Mupirocin 2% ointment	tid	3 days
Vancomycin 5%	tid	14-28 days
Bacitracin (with syst)	tid	5 days
Fusidic acid 4%	tid	14 days
Oral		
Rifampin	600 mg qd	5 days
Trimethoprim Sulfa	160/800 mg bid	5 days
Minocycline	100mg bid	14 days
Ciprofloxacin	750mg bid	14 days

The main problems are the emergence of resistance (particularly with quinolones and rifampin), relapse and recolonization.

What prevention measures to take when a MRSA patient is diagnosed in an institution?

Place the patient in **contact isolation**:
•Strict handwashing; Use of antimicrobial soap for personnel and patient bathing when MRSA contact is involved
•Gloves for direct contact with infected tissues
•Aprons or gowns for patient care
•Mask if coming within 6 feet of patients sputum +
•Patient placement in private rooms whenever possible. No placement of MRSA patients with other high-risk patient in same room

There is NO need to:
- Systematically screen all patients
- Systematically screen medical personnel
- Treat colonized patient or medical care provider

MRSA patients can be transferred or discharged
Hospitals can transfer patients with active infection to nursing homes/extended-care facilities if the clinical manifestations of infection show signs of improvement and if the nursing home/extended-care facility is equipped to manage the wound and necessary antibiotic therapy. Denial of admission to a nursing home/extended-care facility should be based on medical eligibility, not on culture results. The receiving facility must be notified **in advance** that the patient is colonized or infected with MRSA.

A patient colonized by MRSA while hospitalized should be discharged once that accompanying medical condition is under control.

What to do in an outbreak situation in a hospital or long term care facility?
Call the Infectious Disease Epidemiology Section for advice at
1-800-256-2748
•Carry out epidemiologic investigation
•Identify extent of patient colonization
•Identify staff colonized
•Establish links between patients /patient-staff.
•Evaluate relative importance of modes of transmission
– transient hand contamination
– common source carriers
– common source vehicle
•Select appropriate interventions to address epidemiologic situation
•Isolation and cohorting
•Eradication of colonization among patients and staff

What to do if one suspects a community acquired MRSA outbreak (particularly in an institution)?
(MMWR October 26, 2001 / 50; 42: 919-922)
1-Severe skin disease or treatment failures of presumed *S. aureus* skin infection **should be evaluated with appropriate cultures** or other diagnostic tests. Efforts to monitor the etiology of skin disease should be linked to these data to determine whether MRSA is a problem in the facility.

2-Optimal **treatment of MRSA disease** should be based on the infecting organism's **antimicrobial susceptibility** result and, when available, input by infectious disease expertise.

3-Recommend that all patients **practice good personal hygiene:** Close contact among institutionalized individuals may place them at increased risk for transmission of skin-colonizing or skin-infecting organisms.

Recommendations include:
- frequent handwashing, daily showers, easy access to sinks and plain soap (in this setting, the usefulness of antibacterial soap is unknown).
- daily showers
- avoid touching wounds or drainage of others and hands should be washed with soap as soon as possible after touching wounds or dressings.
- Personnel that provide wound care should follow Standard Precautions

Common disinfectants are effective against MRSA

MRSA sensitivity to antibacterial disinfectants is no different from that of other bacteria. Most commonly used disinfectants are effective.